蝶と蛾　*Lepidoptera Science* **68**（3/4）: 81−91, December 2017

Description of a new subspecies of *Pieris erutae* Poujade, 1888 from Eastern Bhutan, with taxonomic notes on the *Pieris napi* group from the Himalayas（Lepidoptera, Pieridae）

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Abstract　Morphological characteristics of the *Pieris napi* group* from the Himalayas（*P. ajaka, P. melaina, P. erutae* and *P. extensa bhutya*）are re-examined, and *Pieris erutae wangchucki* **ssp. nov.**, a new subspecies of *Pieris erutae* Poujade, 1888 from eastern Bhutan is described and illustrated.

Key words　Androcinia, biodiversity, *Pieris ajaka, Pieris erutae*, *Pieris erutae wangchucki*, *Pieris extensa bhutya, Pieris melaina,* taxonomy.

Introduction

The Himalayas is one of the richest regions of butterfly diversity in the world, characterized by its steep, high mountains and deep valleys formed by the collision of the Eurasian and Indian plates. Some little known species of the *Pieris napi* group* are distributed in the region. Talbot（1939）introduced three subspecies of *Pieris napi* from the northern part of the former British India, in addition to a newly described *Pieris extensa bhutya* Talbot, 1939 from eastern Bhutan. The three subspecies were *ajaka* Moore, 1865 from northwestern India, *montana* Verity, 1908 from Sikkim, and *melaina* Röber, 1907 from Tibet. Talbot（1939）indicated their habitats as follows: 1）*ajaka* is distributed on the western edge of the Himalayas, from Murree（northern Pakistan）to Kumaon（northern India adjacent to the western edge of Nepal）, 2）*montana* is distributed in Nachar（northern India）as well as the northeastern region of the Himalayas（Sikkim to Myanmar）, and 3）*melaina* is found in the limited area of Chumbi valley in Sikkim, in addition to "Tibet" as vaguely stated in its original description. In terms of distinct morphological characteristics, the veins in *ajaka* are inconspicuous as in *Pieris canidia* Linnaeus, 1768 and distinct from other species of the *Pieris napi* group*, while the veins are 'thickly' or 'more thickly' suffused by black scales in *montana* and *melaina*. Eitschberger（1983）reviewed the global *P. napi* group* population, and treated both *P. ajaka* and *P. melaina* as distinct species, while *montana* was sunk into a synonym of *P. melaina*. Eitschberger（1983）further introduced *P. erutae* Poujade, 1888 as a distinct species of the *Pieris napi*-group distributed in the eastern edge of the Himalayas in addition to the southeastern part of the Tibetan mountains. Smith（1994）indicated that *Artogeia montanus*（*P. melaina* in the usage of this paper）is distributed in northwestern Nepal（Jumla and Humla districts）. Figure 1 shows the geographical distribution of *ajaka, melaina*（incl. *montana*）, *erutae* and *extensa bhutya* mapped in accordance with Talbot（1939）, Eitschberger（1983）and Smith（1994）.

Recently, we had an opportunity to examine a *Pieris* species（herein after referred to as *P. e. wangchucki*）collected in

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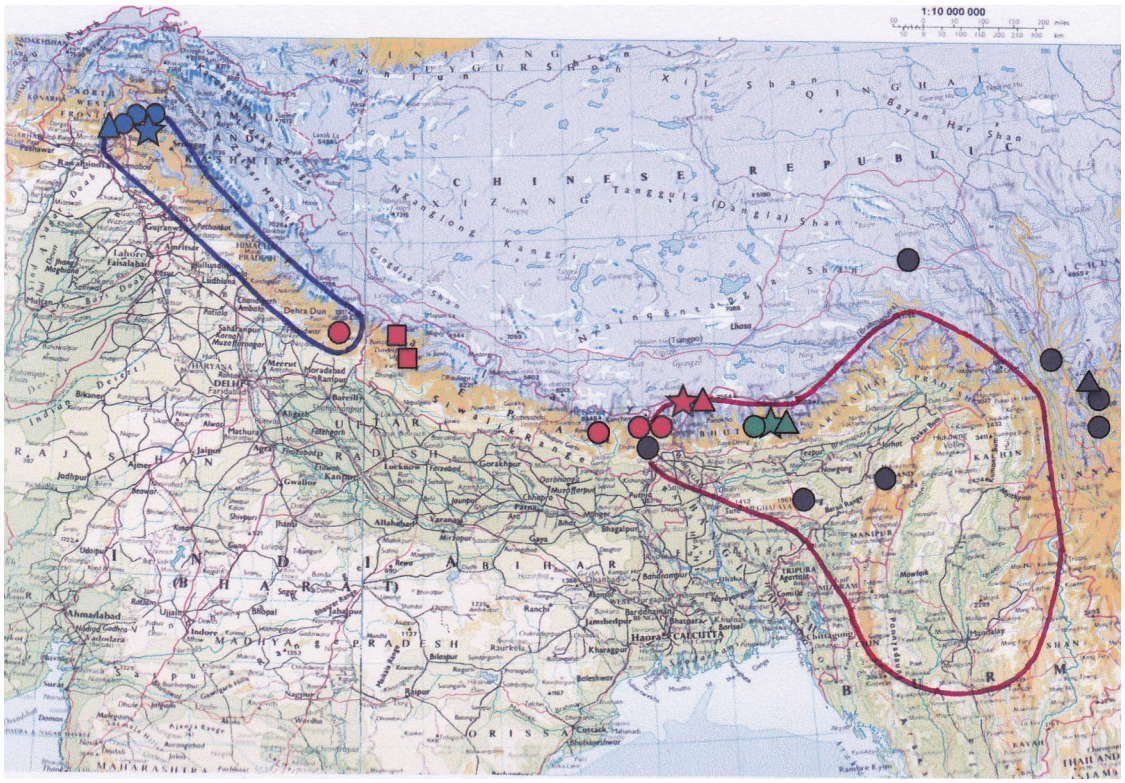


Fig. 1. Distribution map of the *Pieris napi* group* from the Himalayas, and the localities of the specimens examined . Type localities ☆, and the localities of the specimens △. Habitats by Eitschberger (1983) ○, Smith (1994) □ and Talbot (1939) ▭.

●:*Pieris ajaka,* ●:*Pieris melaina,* ●:*Pieris extensa bhutya,* ●:*Pieris erutae*

eastern Bhutan in August 2011 by members of a collaborative expedition between Bhutan and Japan (Wangi *et al*., 2012). The male resembles *Pieris erutae*, but the ground color in the female is distinctly yellowish. We examine the morphological characteristics of *P. e. wangchucki* comparing it with *P. ajaka*, *P. melaina, P. erutae* and *P. extensa bhutya* respectively to verify their taxonomic status. The history of the descriptions in the *Pieris napi* group* from the Himalayas is summarized as follows;

1) *Pieris ajaka* Moore, 1865 (Figs 2-E, F) was described as a distinct species from Lower Kunawur, northern India. Moore (1865) stated that the butterfly occurred chiefly in autumn and was allied to *Pieris gliciria* (a synonym of *Pieris canidia* Linnaeus, 1768), but decidedly distinct from that common species.

2) *Pieris erutae* Poujade, 1888 (Figs 2-K, L) was described as a distinct species, and *Pieris extensa* Poujade, 1888 was described as a variety of *Pieris erutae 'P. erutae* var. *extensa*' in the same paper with the same type locality of Moupin, China (Baoxing in Sichuan) (original text: 'de Mou-Pin (Thibet oriental) rapportés par M. l'abbé A. David'). *P. erutae* is a large species (♂: 55-62mm, ♀: 57-65mm in wing exp.), and *extensa* is even larger (♂: 70 , ♀: 76 mm in wing exp.) than *P. erutae*, and the largest species within the *Pieris napi* group*

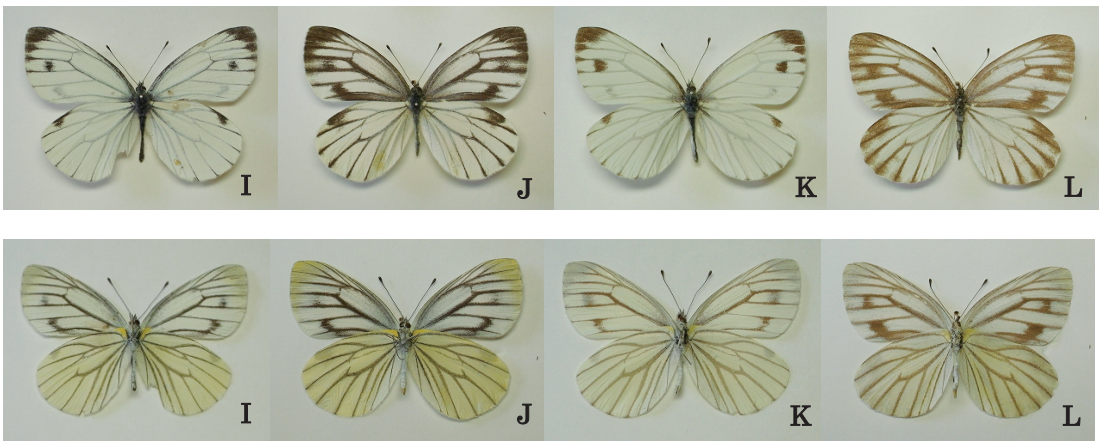
3) Leech (1892-1894) treated *erutae,* Poujade as a variety of *Pieris melete*, from Moupin in spring form, and treated *ajaka* as a local form of *Pieris melete* from the Northwest Himalayas in summer form, while *P. extensa* was treated as a distinct species from western and central China.

4) *Pieris melaina* Röber, 1906 (Fig. 2-G) was described as a distinct species from 'Tibet'. Röber (1906) described *melaina* as possessing 'Upperside of ♀ more or less yellow.' He treated both *P. ajaka* and *P. extensa* as distinct species, while *erutae* was treated as a subspecies of *P. melete*. Röber (1906) vaguely indicated their ranges as follows: *P. ajaka* from Tibet (Kunawur) and Kashmir, *P extensa* from Tibet, and *P. melete erutae* from the East Tibet.

5) *Pieris melete* var. *montana* Verity, 1908 (Fig. 3) was described from Sikkim (Lachin-Lachoong, alt. 2,400-4,800 m), India (original text: 'L'intérieur du Sikhim (Lachin-Lachoonng, entre 2,400 et 4,800 m. d'altitude'). Type specimens were selected from the Oberthür collection. Verity (1905-1911) later considered that *montana* might be the spring form of *ajaka*, but

P. e. wangchucki ♂ ♀ ***P. extensa bhutya*** ♂ ♀

P. ajaka ♂ ♀ ***P. melaina*** ♂ ***P. latouchei*** ♀
(from East coast, China)



P. erutae (Yunnan)♂ ♀ ***P. erutae*** (Sichuan)♂ ♀
(from Eastern Tibet, China)

Fig. 2. The *Pieris napi* group* from the Himalayas.

finally classified both *montana* and *melaina* as races of *P. melete melete,* while *ajaka* was treated as a subspecies of *P. melete*.

6) Evans (1923) treated *ajaka* as *Pieris napi ajaka* from Murree to Kumaon, and *montana* as *Pieris napi montana* irregularly distributed from Sikkim to the Shan States in Burma (Myammar). Evans (1927) copied the above, and added *P. napi melaina* Ver. (sic: Röber is the correct author) from Chumbi Valley, Sikkim.

7) Talbot (1932) classified *ajaka* as a subspecies of *Pieris melete*, distributed in North India, the Shan States and Assam, with two distinct forms, namely f. vern *ajanta* and f. *montana.* He treated *melaina* as a subspecies of *P. melete*, distributed in Tibet including South China and Sikkim. It is interesting to notice that Talbot (1932) treated *P. erutae* as a synonym of *P. orientis* Oberthür from Askold, Far-East Russia, due to the type specimen that Poujade had referred to in its description.

8) *Pieris extensa bhutya* Talbot, 1939 (Figs 2-C, D) was described from 'Eastern Bhutan; Trashiyangsi, 8,000 feet' as an isolated local population of *P. extensa*, with thicker veins and darker ground color.

Talbot (1939) followed Evans (1923), and changed the treatment to make *ajaka*, *montana* and *melaina* subspecies of *P. napi* Linnaeus 1758 instead of *P. melete* Ménétries 1857, after stating 'some of these races are rather distinct, and one of them *melete* Ménétr. has long been regarded as a distinct species, but there is no satisfactory proof of this'.

9) Wynter-Blyth (1957) followed Talbot (1939), and treated *ajaka*, *montana* and *melaena* (sic: *melaina* is the correct name) as races of *Pieris napi*. The race *ajaka* (Muree to Kumaon) was described as 40-55 mm in wing expanse, the race *montana* (Sikkim to Burma. Nachar) 50-60 mm, and the race *melaina* (Chumbi Valley) 50 - 66 mm. He referred neither to *P. melete* nor *P. extensa*.

10) Warren (1961) inspected the androconial scales of most butterflies in the genus *Pieris* and divided them into three groups, namely *rapae*, *napi* and *melete*. Both *ajaka* and *melaina* were included in the *melete*-group due to their large scent cells. Warren (1961) finally included *extensa* into the *melete*-group, although the scent cell was even smaller than in the *napi*-group species.

11) Eitschberger (1983) reviewed the global *P. napi* group* as a whole, and treated *ajaka*, *melaina* and *erutae* as distinct species, while *montana* was sunk into a synonym of *melaina. P. extensa bhutya* remained as a subspecies of a distinct species *P. extensa*.

In this paper, we follow Eitchberger (1983) in considering that there are four valid nominal taxa of the *Pieris napi* group* from the Himalayas. They are *P. ajaka, P. melaina, P. erutae* and *P. extensa bhutya.*

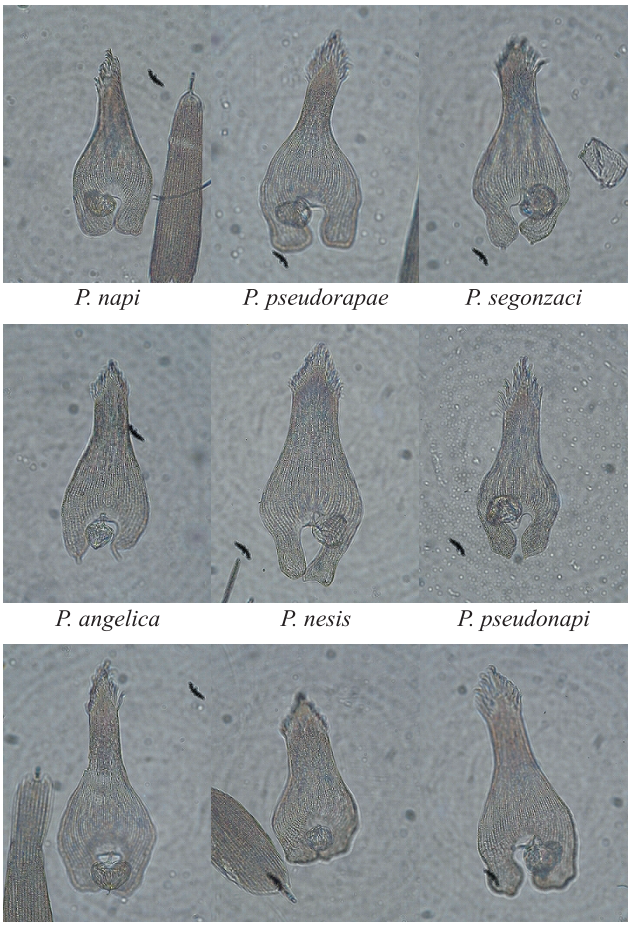
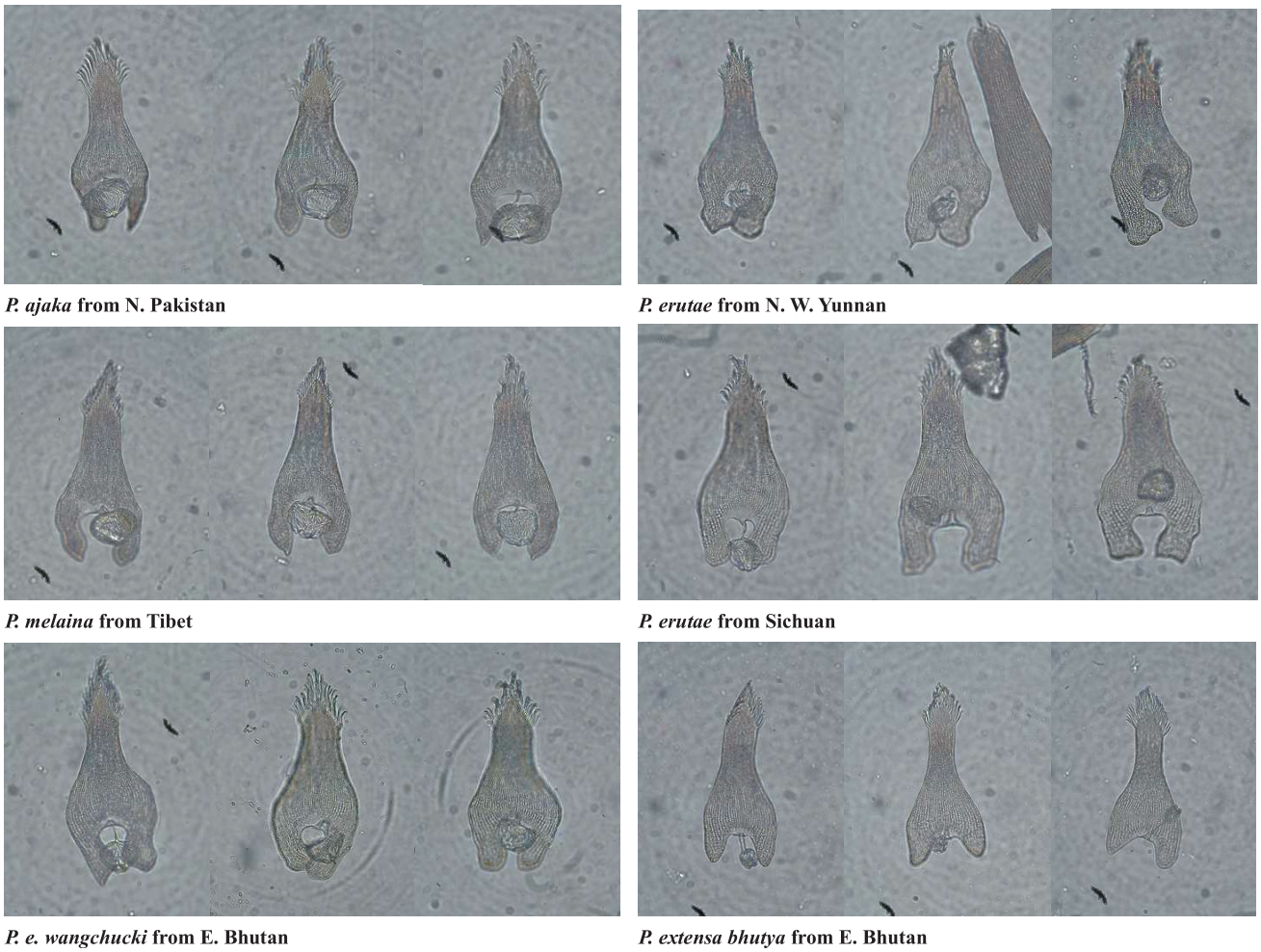


Fig. 3. Androconia of the *Pieris napi*-related species.

Materials and Methods

Specimens of *P. e. wangchucki* (Figs 2-A, B) and *Pieris extensa bhutya* (Figs 2-C, D) were collected in Trashi Yangtse prefecture in eastern Bhutan during 10th-17th August 2011. *Pieris ajaka* (Figs 2-E, F) were collected in Ayubia Murrii = Murree (alt. 2,500 m) in northern Pakistan on the 13th July 2013. *Pieris melaina* (Fig. 2-G) was obtained from a reliable insect dealer with the labels of "*Pieris melaina* ♂, Tibet 1908". *Pieris erutae* were collected in northwest Yunnan in July (Figs 2-I, J) and in Sichuan in September (Figs 2-K, L). *Pieris latouchei* Mell, 1939 (Fig. 2-H) were collected in Zhejiang, East China in March. Other specimens for androconia inspection were obtained from Tadokoro's own collection. The type localities (☆) and the localities of the specimens (△○□) are shown in the Figure 1. Photographs of the type specimens of *P. erutae*, *P. montana* and *P. extensa bhutya* were studied from Eitschberger (1983). The figure of the type specimen of *P. melaina* was studied from Röber (1906). The figure of the type specimen of *P. ajaka* ♀ was studied from Moore (1885), and the photographs of *P. ajaka* and its spring form f. *ajanta* (type specimens) were



***P. ajaka* from N. Pakistan**

***P. erutae* from N. W. Yunnan**

***P. melaina* from Tibet**

***P. erutae* from Sichuan**

***P. e. wangchucki* from E. Bhutan**

***P. extensa bhutya* from E. Bhutan**

Fig. 4. Androconia of the *Pieris napi* group* from the Himalayas.

studied from Verity（1905-1911）. The photographs and sketch drawings of androconia in *P. ajaka* and *P. melaina* were studied from Warren（1961）and Eitschberger（1983）respectively. Androconia were removed from the upper side of the wings in males and observed by optical microscope at 400 magnifications（Figs 3 , 4）. Male genitalia were dissected and observed by stereomicroscope at 20 magnifications after removing membranes and muscles with 20% KOH solution（Fig. 5）.

In this paper, the *Pieris napi* group*（marked with an asterisk）includes systematically not only the *Pieris napi*-related species group but also some *Pieris* species resembling *Pieris napi* in wing markings, such as *Pieris melete* and *Pieris extensa*［ex. Tuzov（1997）］.

Abbreviations: MoAF = Ministry of Agriculture and Forests, Bhutan; DoFPS = Department of Forests and Park Service, Ministry of Agriculture and Forests, Bhutan; NEC = National Environment Commission, Bhutan; UWICE = Ugyen Wangchuck Institute for Conservation and Environment, Ministry of Agriculture and Forests, Bhutan; BWS = Bumdeling Wildlife Sanctuary; BSJ = Butterfly Society of Japan.

Description of a new subspecies of *Pieris erutae* Poujade, 1888

Pieris erutae wangchucki Tadokoro, Wangchuck & Wangdi ssp. nov.（Figs 2-A, B）

Pieris erutae montana（nec. *montana* Verity, 1908）: Wangdi *et al.*, 2012.

Diagnosis: Male forewing upperside with black markings more prominent in apex, space-1b and space-3. Androconia swollen, and scent cell slightly larger. Female ground color on wing upperside yellowish.

Description: -Wing expanse: 52.5-59.0 mm in males（n = 8）, 510-59.0 mm in females（n = 4）.

-Wing markings（male）: Wings white, with blackish venations. Black markings at apex, space 1b and 3 of forewing upperside prominent, with the one in space 3 rounded. Forewing cell not

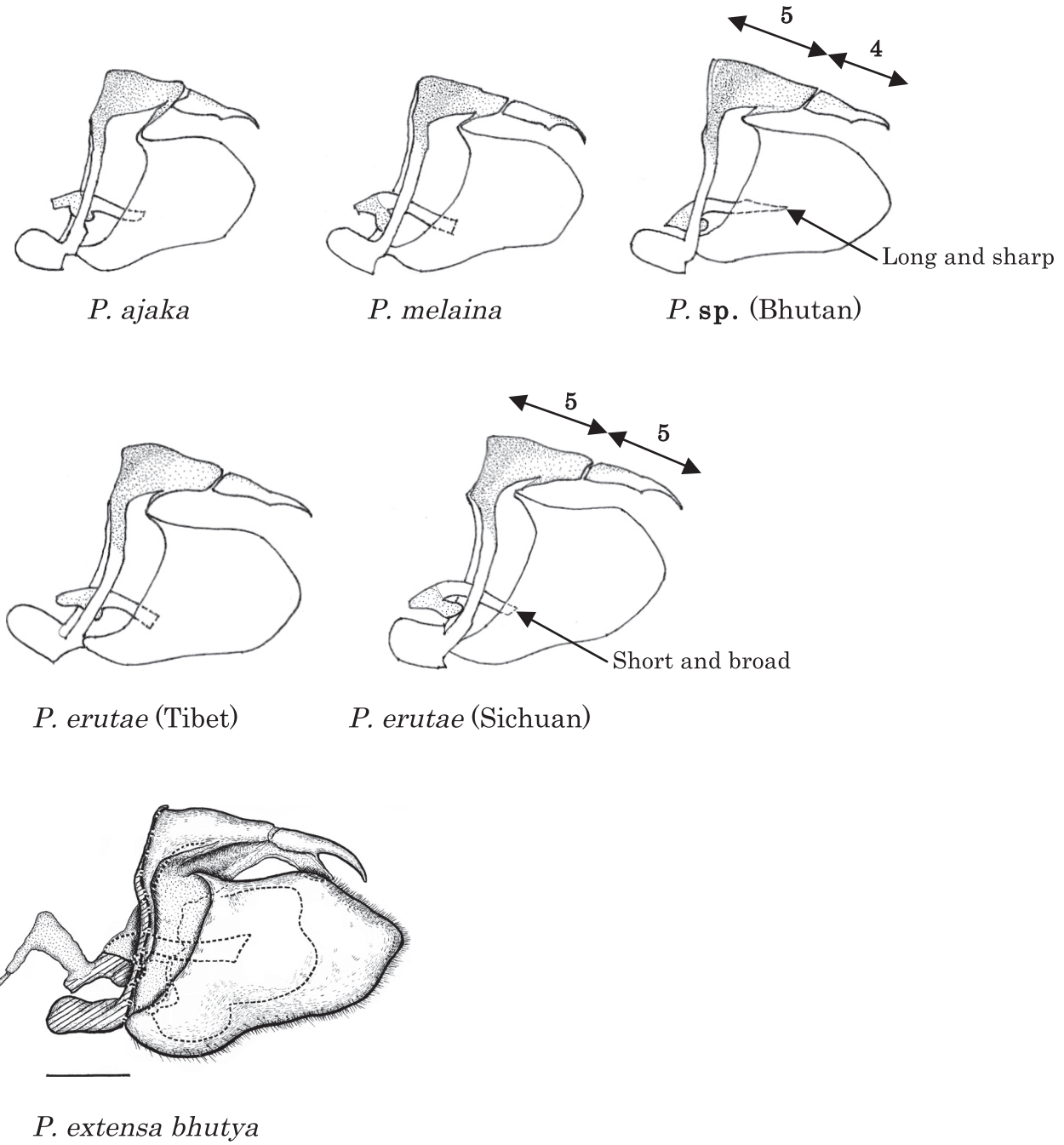


Fig. 5. Male genitalia of the *Pieris napi* group* from the Himalayas. Scale bar 1 mm.

thickly dusted on both upper and underside. Forewing underside white, but apex pale yellow. Ground color on hindwing underside pale yellow. Basal spot of space 8 vivid yellow.

-Wing markings (female): Resemble ssp. *erutae*, but ground color on upperside yellowish as in *P. melaina*. *P. latouchei* (Fig. 2-H) from East China is also yellowish, but only on forewing upperside. Forewing cell not as thickly dusted on both upper and underside as ssp. *erutae*.

-Androconia: Scent cell slightly larger than ssp. *erutae* from N. W. Yunnan or Sichuan but smaller than *Pieris melaina.* Form of androconia swollen (Fig. 4).

-Male genitalia: Tegumen somewhat longer. Phallus long and sharp (Fig. 5).

Specimens examined: Holotype ♂, 17 VIII 2011, Tobrang [Terphel-Damar] (27-43'55" N., 91-25'44" E., alt. 2,000 m) in Trashi Yangtse pref., eastern Bhutan; Paratypes 4♂4♀, 13-16

VIII 2011, Tobrang［Terphel］(alt. 2,200 m) in Trashi Yangtse pref., eastern Bhutan; Paratypes 2♂, 12 VIII 2011, Tobrang ［Terphel-Langkar］in Trashi Yangtse pref., eastern Bhutan; Paratype 1♂, 10 VIII 2011, Trashi Yangtse (alt. 1,800-1,900 m) in Trashi Yangtse pref., eastern Bhutan.

Depository: All type specimens are preserved in the Wildlife Conservation Division, MoAF, Royal Government of Bhutan in Thimphu.

Habitat and biology: This species frequents buckwheat fields, pastures, forest clearings and forest fringes along mountain paths in a steep valley surrounded by dense forests near Tobrang ［Terphel］and its surroundings. They fly slowly, close to the ground, and often visit buckwheat flowers.

Generation: Probably multi generations.

Etymology: The subspecific name *wangchucki* is dedicated to the Fourth King of Bhutan, Jigme Singye Wangchuck, for his visionary and exemplary work of championing environmental conservation across the globe.

Results

Based on our examination of the specimens, the distinct morphological characteristics of *P. ajaka*, *P. melaina*, *P. erutae, P. extensa bhutya* and *P. e. wangchucki* are indicated as follows:

［Wing expanse］

P. ajaka: 49.5 mm in male, 45 mm in female; *P. melaina*: 46.5 mm in male; *P. e. wangchucki*: 52.5-59.0 mm in males (n = 8), 51.0-58.5 mm in females (n = 4); *P. erutae*: 50-65 mm ［Tadokoro *et al.* (2014)］; *P. extensa bhutya*: 63.0-64.0 mm in males (n = 2).

Both *P. ajaka* and *P. melaina* are medium sized, but smaller than *P. e. wangchucki* or *P. erutae,* and far smaller than *P. extensa bhutya. P. e. wangchucki* is a large species within the range of *P. erutae*. *Pieris extensa bhutya* is the largest in wing expanse.

Danaus ajaka ［Moore (1903-1904)］and *Pieris napi montana* ［Talbot (1939), Wynter-Blith (1957)］are considered to include the large species of *Pieris erutae*.

［Wing markings］(Fig. 2)

As described by Moore (1865), *P. ajaka* is allied to *P. griciria* (a synonym of *P. canidia*) on the basis of its inconspicuous veins, and wing markings distinct from other members of the *P. napi* group*. In contrast, *P. melaina* is distinguished by thickly suffused basal and veins, and yellowish ground color in females, as described by Röber (1906). *P. e. wangchucki* resembles *P. erutae*, but black markings of forewing upperside in apex, space-1b and space-3 are more prominent in males. Furthermore, the yellowish ground color of the upperside wing in females as in *P. melaina,* also resembles *P. latouchei* distributed in southeast China.

［Androconia］(Figs 3, 4)

Both *P. ajaka* and *P. melaina* were classified as races of *Pieris melete* by Warrean (1961) due to their large scent cells. Eitschberger (1983) also illustrated their large androconia. On the other hand, *P. erutae* represents the *napi*-related species in the region with a medium sized scent cell. As indicated by Tadokoro *et al.* (2014), scent cells in the *P. napi*-related species are about the same size (Fig. 3). The scent cell in *P. e. wangchucki* is slightly larger than in *P. erutae* (*P. napi*-related species), but a little smaller than in *Pieris melaina.* Furthermore, *P. extensa bhutya* is distinct by having the smallest scent cell within the *P. napi* group*. Therefore, these species can be easily identified by scent cell size. *Pieris ajaka* is the largest (but still smaller than *P. melete* from Japan), *P. melaina* is the second, *P. e. wangchucki* is the third, followed by *P. erutae* (*P. napi*-related species) and *P. extensa bhutya* is the smallest within the five (Fig. 4). Of interesting note is the correlation between the sizes of scent cell in the androconia and the longitudinal location of the species: the further west the species, the larger their scent cells. In addition to the size of scent cell, the form of androconia in *P. e. wangchucki* is very broad as in the spring generation (Fig. 4). Normally, the form of androconia in the second/summer generation is more slender according to Warren (1961).

［Male genitalia］(Fig. 5)

The following distinct morphological characteristics are observed: 1) size of genitalia in both *P. ajaka* and *P. melaina* are more compact than the those in *P. e. wangchucki*, *P. erutae* and *P. extensa bhutya*, of which the latter is the largest; 2) the ratio in length of tegumen and sociuncs is approximately 5:5 in *P. ajaka, P. melaina* and *P. erutae*, but 5:4 in *P. e. wangchucki* and *P. extensa bhutya*; 3) phallus is short and bulging in *P. ajaka, P. melaina* and *P. erutae*, long and sharp in *P. e. wangchucki* and *P. extensa bhutya*; 4) tegumen is flat in *P. melaina,* weakly waved in the others. Lengths of male genitalia (n = 1): *P. ajaka* = 2.6 mm; *P. melaina* = 3.0 mm; *P. e. wangchucki* = 3.1 mm; *P. erutae* = 2.8 mm (Tibet), 3.1 mm (Sichuan); *P. extensa bhutya* = 4.4 mm.

Discussion

The following species of the *Pieris napi* group* are distributed in the Himalayas.

1. *Pieris ajaka*: a medium sized species, with the largest scent cell in the androconia among the *Pieris napi* group* from the Himalayas, and inconspicuous veins as in *Pieris canidia*. We infer that this species is included in neither *P. napi*-related species nor *P. melete*, but has an independent phylogenetic lineage, judging from the intermediate size of its scent cell. We consider that f. *ajanta* with its small size is the spring form of *P.*

ajaka, and probably also includes dwarf individuals, which often occur with *P. erutae* in the Tibetan region, according to Tadokoro (2015).

2. *Pieris melaina*: a medium sized species, with large scent cells in the androconia but a little smaller than in *Pieris ajaka.* The wing base and veins are thickly suffused by black scales, especially the underside, and the ground color in the female is yellowish with thickly bordered veins. We infer that this species is included neither in the *P. napi*-related species nor in *P. melete*, but has an independent phylogenetic lineage, which is probably closed to *P. ajaka,* judging from the intermediate size of its scent cell. As for *Pieris montana*, a medium sized species from Sikkim, we agree with the suggestions of Warren (1961) and Eitschberger (1983) that this butterfly should be treated as a synonym of *Pieris melaina* (Figs 2-G, 4), judging from its wing size and wing markings, as well as its type locality suggested by Talbot (1939).

3 . *Pieris extensa bhutya*: the largest species of the *P. napi* group*, with the smallest scent cell in the androconia. *Pieris extensa* has an independent phylogetetic lineage as indicated by Tadokoro et al. (2014).

4. *Pieris erutae*: a large species with medium sized scent cells as in all other *napi*-related species. According to Tadokoro *et al.* (2014).

5. *Pieris erutae wangchucki*: a large subspecies, with intermediate scent cell size between *P. melaina* and *P. erutae* in size. Although this butterfly may be a distinct species, we treat it as a new subspecies of *P. erutae* in this paper, for the following reasons:

-Phylogenetic analyses of mt DNA for this butterfly have not yet been completed.

-It has similar wing expanse, wing shape and wing markings to *P. erutae*, especially in the male.

-The yellowish ground color in the female may possibly be an intraspecific variation.

-The size of the scent cells varies within the same species, even in our specimens. Only a slight difference in scent cell size may not be good enough evidence to describe this butterfly as a distinct species.

-*Pieris erutae* from eastern Bhutan may have evolved in a similar way to *Pieris extensa*. *P. extensa bhutya* was described from Trashi Yangtse of eastern Bhutan, the same locality as *P. erutae wangchucki*, and the nominotypical subspecies of *P. extensa* and *P. erutae* are from the same type locality Mou-pin (Baoxing) of Sichuan, China.

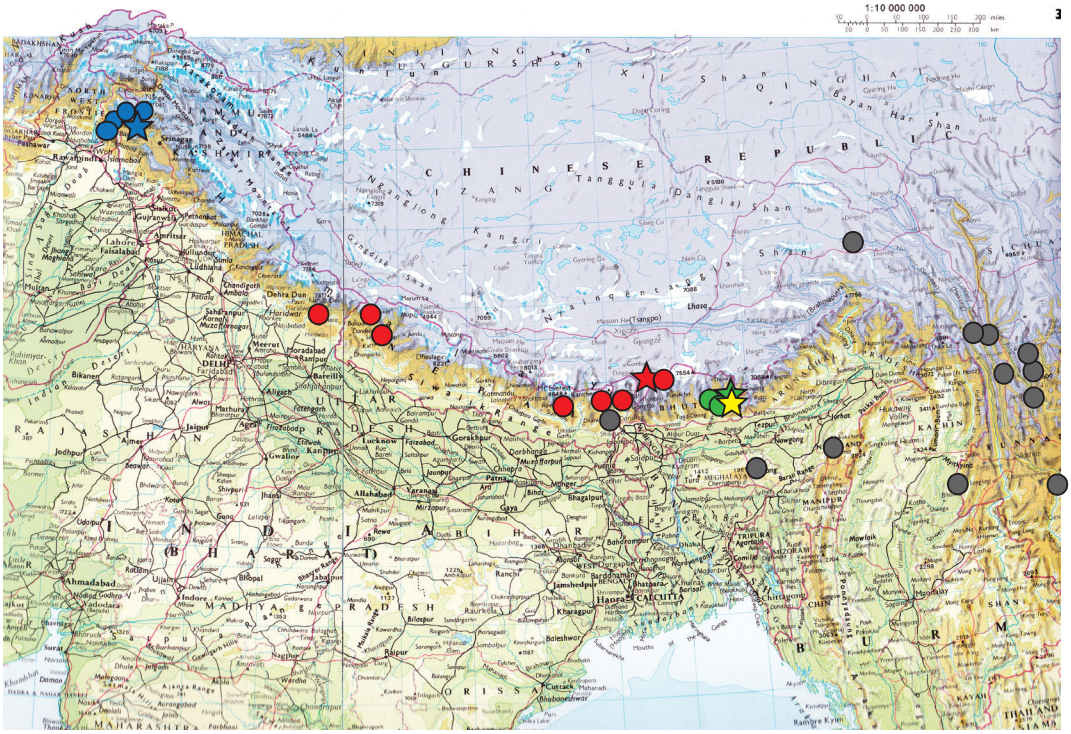


Fig. 6. Distribution map of the *Pieris napi* group* from the Himalayas.
Type localities ☆, and the habitats indicated by Eitschberger (1983), Smith (1994) and the authors ○.
●:*Pieris ajaka,* ●:*Pieris melaina,* ●:*Pieris extensa bhutya,* ●:*Pieris erutae* ●:*Pieris erutae wangchucki*

Table 1. Morphological characteristics of the *Pieris napi group** from the Himalayas 2017

Taxon / Specimen（in Fig. 2）			Type locality & （locality of the specimens）	Morphological characteristics				
				Wing-expanse （mm）	up wing ground color	Venations and wing markings	Androconia （Fig. 4）	Male Genitalia （Fig. 5）
Pieris napi-group*	*ajaka*	E&F	N. India ［Lower Kunawur, Punjab］ （Murrii, Pakistan）	Medium ♂: 49.5 ♀: 45.0	♂: White ♀: White	♂: up - Inconspicious veins （Allied to *P. canidia*） ♀: upf – Black marking at space 1b continue to 1a, and prominent	Scent cell: Large （Larger than *melaina*） Arm: long, open	Medium L=2.6mm Ratio in length of tegmen and sociuncs: 5:5
	melaina	G	［Tibet］ Chumbi Valley, Sikkim （Tibet）	Medium ♂: 46.5	♂: White ♀: ［Yellowish］	♂: Thickly suffused veins and basal. ♀: ［Thickly suffused veins. Uph cell = basal suffused and a slender streak continue from vein 5.］	Scent cell: Large Arm: long, open	Medium L=3.0mm Ratio in length of tegmen and sociuncs: 5:5
	Pieris napi related species *erutae*	I &J K&L	W. China ［Moupin = Baoxing, Sichuan］ （Sichuan）& （Zhongdian dist., N.W. Yunnan）	Large ♂♀ : 50-65 ［♂: 55-62］ ［♀: 57-65］	♂: White ♀: White	♂: Veins and basal not suffused as in *melaina*. ♀: upf = cell dusted.	Scent cell: Medium Arms: long, closed	Medium 2.8 mm（Tibet） Ratio in length of tegmen and sociuncs: 5:5
	erutae ssp. *wangchucki*	A&B	E. Bhutan ［Transhi yangtse］ （Transhi yangtse）	Large ♂: 52.5-59.0 ♀: 51.8-58.5	♂: White ♀: Yellowish （*P. latouchei* is also yellowish, but uph only.）	♂: Resemble ssp. *erutae,* but, black markings in apex and space 1b, 3 are prominent. ♀: Resemble ssp. *erutae* and *P. latouchei,*but upf cell not as thickly dusted as in ssp. *erutae* or *P. latouchei.*	Scent cell: Medium （Slightly larger than *erutae*） Arm: long, closed Lamina: swollen	Medium 3.1mm Ratio in length of tegmen and sociuncs: 5:4
	extensa ssp. *bhutya*	C&D	E. Bhutan ［Transhiyangi］ （Transhi yangtse）	Extra large ♂: 63.0-64.0	♂: White ♀: White	Wing roundish. Black marking in apex crescent shape. ♂; uph: Vein-7 suffused by black scales. ♀: uph: Marginal and sub marginal dusted.	Scent cell: Small （Smallest in *P. napi*-group） Arm: short, open	Large L=4.4mm Ratio in length of tegmen and sociuncs: 5:3

Remarks: ［ ］Referred to the original description

Abbreviations: upf= upperside of forewing, uph = upperside of hindwing, unf = underside of forewing, unh = underside of hindwing, L = length

Conclusion

Based on the results and discussions above, we conclude that four distinct species with some intraspecific taxa of the *Pieris napi* group* are distributed in the Himalayas and adjacent Tibetan mountains as follows:

1. *Pieris ajaka* Moore, 1865-TL: Lower Kunawur, northwestern India.

Distributed in northern Pakistan and northwestern India.

2. *Pieris melaina* Röber, 1906-TL: Tibet and Chumbi Valley in Sikkim, India.

Distributed in northern India, Nepal and Sikkim.

3. *Pieris erutae* Poujade, 1888 -TL: Moupin, (Baoxing) in Sichuan, China.

3.a. *Pieris erutae erutae* Poujade, 1888

Distributed in Sichuan and Yunnan in China and the northern mountainous area of Vietnam, Laos and Myanmar, as well as the eastern part of India.

3.b. *Pieris erutae wangchucki* Tadokoro, Wangchuck & Wangdi ssp. nov. -TL: Trashi Yangtse in eastern Bhutan.

At present, distributed only in eastern Bhutan.

4. *Pieris extensa* Poujade, 1888-TL: Moupin, in Sichuan, China.

4.a. *Pieris extensa extensa* Poujade, 1888

Distributed in Sichuan and the southern end of Shaanxi, China.

4.b. *Pieris extensa yunnansia* Tadokoro & Wang, 2014-TL: Zongdian district, N. W. Yunnan.

Distributed in N. W. Yunnan, China

4.c. *Pieris extensa bhutya* Talbot, 1939-TL: Transhiyangi in eastern Bhutan.

Distributed in eastern Bhutan.

Table 1 shows the summary of the morphological characteristics of the *Pieris napi* group* from the Himalayas. Distribution map is shown in the Figure 6.

Acknowledgments

We express our sincere thanks to His Majesty the Druk Gyalpo Jigme Khesar Namgyel Wangchuck, the Fifth King of Bhutan, for his kindness. We express our thanks to the former Honorable Minister of MoAF, Pema Gyamtsho and the Secretary of NEC, Ugyen Tshewang for providing the opportunity to study the butterfly fauna of Bhutan. Thanks are also due to the former Chairman of the Board of Directors of the Research Institute of Evolutionary Biology, The late Dr T. Tannowa for access to the Royal Government of Bhutan. The BSJ members are indebted to DoFPS, NEC, UWICE, and BWS for permissions, agencies, guides, and information. This research was conducted by the permission of the Department of Immigration, Ministry of Home and Culture Affairs (No. OO201212339), as well as the Nature Conservation Division (No. 0903) and Wildlife Conservation Division (CITES certificate/permit No. WCD-39), MoAF. Furthermore, we hereby express our sincere gratitude to Ulf Eitschberger for allowing us to cite any part of his book in this paper, and to all members of the Takao Seminar for providing us with a lot of valuable information and advice. We are also deeply grateful to Neil Moffat for his critical readings of the manuscript. This study was supported in part by a Grant-in-Aid for Scientific Research (C) (Nos 23570111 and 26440207 to MY) from the Japan Society for the Promotion of Science.

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摘　要

ブータン東部産 *Pieris erutae* の新亜種記載，及びヒマラヤ産 *Pieris napi* グループに関する分類学的考察（田所 輝 夫・Sonam Wangchuk・Sonam Wangdi・Karma Wangdi・Sherub・Rinchen Wangdi・Sangay Drukupa・原田基弘・斎藤基樹・青木俊明・山口就平・五十嵐昌子・渡辺康之・矢後勝也）

パキスタン北部からインド北部さらにネパールを通ってブータン，ミャンマー，そして中国雲南省北部へと続くヒマラヤ山脈は，ユーラシア・プレートとインド・プレートとの衝突によって形成された急峻な高山と深い峡谷を特徴とする地殻断層線である．この地殻断層線とその周辺域では豊富なチョウ類多様性が報告されている（Fig. 1）．ここに分布する *Pieris napi* グループ*［例えば Tuzov（1997）等］には，ブータン東部に局所的に棲息する *Pieris extensa bhutya*（Figs 2-C, D）の他，インド北西部からパキスタン北部にかけて棲息する *Pieris ajaka*（Figs 2-E, F）やインド北部からネパール西部にかけて分布する *Pieris melaina*（Fig. 2-G）等，あまり知られていない種が棲息している．後者の 2 種は，いずれも発香鱗の香嚢サイズが *Pieris napi* 種群に比較すると明らかに大きく（Fig. 3），そのため Warren（1961）により *Pieris melete*（スジグロシロチョウ）の race（亜種階級相当）に分類されている．一方，Tadokoro *et al.*（2014）によると，中国四川省，雲南省からヒマラヤ東端にかけて分布する *Pieris erutae*（Figs 2-I, J, K, L）は，発香鱗の香嚢サイズも他の *napi* 種群（*napi*-complex）と同程度であり（Fig. 3），分子系統解析に基づいた分類でも *napi* 種群に属することが確認されている（ヒマラヤの *Pieris napi* グループ *各種の記載の経緯に関しては本文参照）．これらのチョウに加えて，日本とブータンの共同学術調査隊が 2011 年 8 月に行ったブータン東部での蝶類調査の際に採集した *napi* グループ*種（Figs 2-A, B）を形態学的に総合比較することで，ヒマラヤ山脈沿いに分布する *napi* グループ*の分類学的考察を行った．

その結果，この地域に分布するのは少なくとも以下の 4 種があることが確認された．1）*Pieris ajaka*（Figs 2-E, F）: 中型種．発香鱗の香嚢のサイズは 4 種中最大（Fig. 4）．翅脈が *napi* グループ*の他種に比較して目立たないことから，♂はタイワンモンシロチョウに似る．パキスタン北部からインド西北部（カシミール地方）にかけて分布．2）*Pieris melaina*（Fig. 2-G）: 中型種．発香鱗の香嚢のサイズは 3 種中 2 番目に大きい（Fig. 4）．基部は黒鱗に覆われ，♀の地色は黄色く翅脈は黒く縁取られる．インド北部からネパールにかけて分布．なお，インドのシッキム地方をタイプ産地とする *Pieris montana* は，Eitschberger（1983）により *P. melaina* のシノニムとされており，筆者らもその見解を支持するものである．3）*Pieris extensa bhutya*（Figs 2-C, D）は 4 種中最大の開翅長を有すが，発香鱗および香嚢は *napi* グループ*中最小である（Fig. 4）．4）*Pieris erutae*（Figs 2-I, J, K, L）: 大型種．発香鱗の香嚢のサイズは中程度で，他の *napi* 種群とほぼ同サイズ（Fig. 4）．中国四川省，雲南省からミャンマー北部を経てブータンに至るまで広く分布する．ブータン東部産の *napi* グループ*種も大型で，♀の表面地色の違いや発香鱗の形状・香嚢サイズの違い等から独立種である可能性もあるが，それらは種内変異と考えられなくもない程度の差であることから，当報文では別種としては扱わず，*P. erutae* のブータン東部産の新亜種として記載をするにとどめる．

Pieris erutae ブータン東部産の新亜種記載

Pieris erutae wangchucki Tadokoro, Wangchuck & Wangdi **ssp. nov.**（Figs 2-A, B）

ブータン東部 Trashi Yangtse（Fig. 7）をタイプ産地とする新亜種 *Pieris erutae wangchucki* の形態的特徴は，名義タイプ亜種（Figs 2-K, L）と比較して，1）♂の前翅表面の翅端および第 1b 室，第 3 室の黒斑が顕著．2）♀翅表の地色が黄色味を帯びる．3）発香鱗の香嚢のサイズは名義タイプと比較するとやや大きく，*Pieris melaina* と比較するとやや小さい（Fig. 4）．4）ラミナの形状は太く，春型のような形質を有する（Fig. 4）．5）♂生殖器では tegumen が sociuncus に対して若干長く，phallus は長く先端が尖っている（Fig. 5）．亜種名 *wangchucki* はブータン王国第 4 代国王 Jigme Singye Wangchuck の世界規模の環境保護活動を称えて献名された．*Pieris erutae wangchucki* のタイプ標本はブータン王立政府の農業森林省野生動物保護局に保管される予定．なお，Wangdi *et al.*（2012）で紹介した *Pieris erutae montana* はこのチョウである．

なお，上記の検討結果からヒマラヤ山系に分布する *napi* グループ*を4 種 1 亜種に分類した（本文参照）．これらのチョウの形態的特徴を Table 1 に纏め，分布図は Figure 6 に示す．

（Received October 1, 2016. Accepted May 14, 2017）